

former sense during his absence; that is, that he has had a memory image of him?"

For my part, I cannot doubt this.

Prof. Wheeler attempts to explain away the evidence on which good naturalists—Leuckart, Rontanes, and others—have relied, and in several cases it seems to me that he does so satisfactorily. I do not myself regard the supposed case of ants dropping intentionally from ceilings on to food as definitely proved, but when Prof. Wheeler explains, or attempts to explain, it away by suggesting that "it may be a much more frequent method among ants of clearing vertical distances than has been supposed," one cannot but ask how it originated, and how it became so frequent.

The evidence, indeed, is contradictory, and difficult to reconcile. This applies not merely to the facts recorded by different observers. I have myself met with cases apparently showing intelligence, and others which seemed to imply the very reverse. Might not, however, the same be said in the case of man himself?

In conclusion, I may say that the illustrations are numerous—nearly 300—well chosen, and most of them good. Prof. Wheeler is much to be congratulated on having produced an excellent work, for which naturalists will, I am sure, be grateful.

AVEBURY.

PRACTICAL METHODS FOR THE BIO-CHEMICAL LABORATORY.

Handbuch der biochemischen Arbeitsmethoden. By Prof. Emil Abderhalden. I., Erster Band, allgemeiner Teil, erste Hälfte. Pp. iv+512. Price 18 marks. II., Zweiter Band, spezieller Teil, erste Hälfte. Pp. iv+496. Price 18 marks. (Berlin and Vienna: Urban and Schwarzenburg, 1909.)

THESE two volumes form the first consignment of a comprehensive handbook of practical methods for the biochemical laboratory, which is being written by no fewer than sixty-four contributors under the guidance of Prof. Emil Abderhalden.

The second halves of each of the present volumes are promised shortly, and the third volume within the year. When it is remembered that the editor is also engaged upon research work in the laboratory, as well as his many contributors, and is, moreover, editing an equally colossal work now appearing, one can but wonder at the rapidity of German cooking of literature of this sort.

It is a pity that the articles are not published separately, as monographs for those specially interested in the individual subjects, for this would save purchasers buying a great deal of matter which they, in most cases, do not want in order to possess a much smaller part of value to them.

As it stands the work has no general interest, and while it may be serviceable in parts as a reference laboratory book, it will scarcely prove attractive or profitable for the private purchaser.

One wonders, in looking over the table of contents of the present and contemplated volumes, why the preference is made that it is issued in three volumes, since

by the simple device of making two halves of each of these divisions it comes to be in six volumes. It might equally well have been issued in one volume of six parts, each part forming a good sized volume; or in two volumes each of three parts; or in six volumes each of one part; or there might have been another and even better alternative.

The work can only be intended for the assistance of the research worker in a biochemical laboratory, and, looking at the matter from his point of view, it is surprising that the editor has allowed the first of the present volumes to appear in his work. All that is novel or interesting to the researcher in biochemistry of the five hundred pages it contains might readily, and with great gain in interest and utility, be compressed into fifty pages. As it stands it looks like nothing more than a glorified collection of catalogues of dealers in laboratory supplies; with the names of the dealers and prices of the commodities left out, much to its disadvantage. Scores of pages are sacrificed to drawings, photographs, and descriptions of apparatus with which we all have been familiar from our youth onwards in our everyday laboratory work. The first article in the volume dealing with this kind of thing occupies 282 pages; the new matter in it could easily be put into thirty pages. If the prices and makers' names were given, it might be of some service in the laboratory; as it is, to order any of the newer apparatus which suited any particular purpose, one would have to refer from the present work to the original paper by the inventor of the apparatus, where possibly the information might be obtained.

In striking contrast with this article of 282 pages is the one succeeding it, of less than seven pages, on the ultra-microscope, written by Fr. N. Schulz, of Jena. Knowing the valuable work of this author in the particular field in question, one expected something good here; but there is nothing new. It might almost be a reprint, as are the illustrations in it, of one of the advertisements of Carl Zeiss advertising the instruments.

There follow on this all too short article a number of lengthy ones on ultimate organic analysis, ash determinations, &c. Nearly all this matter has been written many times before, is contained in all practical works on organic chemistry, and is familiar to any but the merest tyro in biochemical work. For example, illustrations with descriptions of the combustion furnace and the combustion tube and its filling are given; eighteen pages are used up in descriptions of the Kjeldahl method for determining nitrogen, and illustrations are given of most of the modifications which perverted human ingenuity and waste of genius have given rise to for carrying out that somewhat simple method of analysis. Fourteen pages in a special article go to a description of specific-gravity methods—why not instead refer the reader to an elementary work on physics?

The second of the two volumes before us will be of more service to the biological chemist whose path is touched by the articles contained therein; these articles deal with the preparation, separation, and qualitative and quantitative estimation of the important lower and

higher alcohols, the carbohydrates, the fats and waxes, the phosphatides, the vegetable proteins, and the animal proteins. The volume concludes in the middle of an article by the editor on the disintegration products of the proteins, characterised by much work of a patient and laborious type. The reader is deserted in the middle of a sentence, with "möglichst" for his last word, but it may be confessed that one can wait for the next issue of the fascinating narrative with more patience than one was able to command in earlier days of reading serial literature.

The articles in this part are of unequal value and exhaustiveness; that on the phosphatides is much too short; very valuable are the three articles, on sugars by B. Tollens, that on glycogen by K. Grube, and especially that on the proteins of the vegetable world by T. B. Osborne, which is a model of what an article on practical methods for the laboratory ought to be.

Such articles as these make the work essential in a biochemical laboratory, but it is a pity that they cannot be purchased as monographs in the particular subjects.

BENJAMIN MOORE.

THE LIGHT FROM THE SKY.

Meteorologische Optik. By Prof. J. M. Pernter. Section IV. Pp. i-xvii, 559-799. By Felix M. Exner. (Vienna and Leipzig: W. Braumüller, 1910.)

THIS volume is the fourth part of the late Prof. Pernter's work on meteorological optics, a notice of the earlier parts of which appeared in NATURE on April 18, 1907. It was undertaken in March, 1908, by Dr. Exner at Pernter's request, at a time when the latter's condition of health not only made it impossible that he should complete the work himself, but prevented him from giving any material assistance or advice in its preparation. The scope of the section was clearly indicated in the original plan of the work, and as regards the method of presentation Exner has successfully followed that of the preceding sections; but he had no notes to assist him, and the volume must therefore be regarded as Exner's work, except in so far as he has utilised, in some portions, Pernter's previously published papers.

In pursuance of the general scheme outlined in the previous notice above referred to, this fourth section is devoted to the discussion of those phenomena which are due to the action of the minute particles of all kinds which are always present in the atmosphere, among which must be included the gaseous molecules themselves. Thus the first two chapters deal with the colour and polarisation of sky-light, the third treats of the loss of light in passing through the atmosphere and the general brightness of daylight, while in the fourth chapter is given a brief account of what are called the phenomena of twilight, the optical effects associated with sunrise and sunset.

Of all the many interesting problems the discussion of which falls under the head of meteorological optics, that of the colour of the sky, with the associated questions as to the polarisation of sky-light, its intensity and composition, and the effects of atmospheric absorption, is perhaps the most fascinating. Less

striking only because not exceptional, in the sense in which this adjective applies to the appearances dealt with in the earlier sections, even for the unscientific observer the everyday recurrence of the phenomena fails to diminish their appeal to his artistic sense and imagination. For the physicist, the satisfactory explanation of all the main features, apart from the quantitative uncertainty in the details which is an almost inevitable consequence of the complexity of the conditions, must be ranked among the triumphs of science, and constitutes one of the most beautiful applications of the wave theory of light.

The view has long correctly been held that the colour of the sky is due to the presence in the atmosphere of suspended particles, and the explanation was rendered more certain by the experiments of Brücke in 1853 and of Tyndall in 1868 on the colour and polarisation of the diffused light from artificially "clouded" media. The first exact account as to the manner in which the particles produced the effects observed was, however, given by Lord Rayleigh in 1871, in his paper on the light from the sky, its polarisation and colour. It was there shown that the presence in the atmosphere of particles of dimensions small compared with the wave-length of light would give rise to secondary radiations of intensity inversely proportional to the fourth power of the wave-length, and completely polarised in the plane at right angles to the direction of the primary radiation from the sun. In this secondary, diffused radiation, the short waves would therefore greatly preponderate, and the colour seen would be blue or violet, while the long waves would be the more readily transmitted, and the primary radiation seen through such an atmosphere would tend to be orange or red. At the same time, Rayleigh disposed of Clausius's theory that the phenomena were due to the presence in the atmosphere of small—but not small relatively to the wave-length—hollow spherical vesicles reflecting and refracting according to the ordinary laws for extended media. In a much later paper Rayleigh has given good reason for inferring that at least one-third of the scattered light is diffracted from the molecules of the air themselves (see also NATURE, March 10, 1910, p. 49).

One of the merits of Exner's discussion of the subject is the care with which he has followed out the application of Rayleigh's theory in the light of the best recorded observations. These relate to colour, polarisation, extinction coefficients, the general brightness and the distribution of brightness of the sky, &c.; indeed, the whole volume may almost be regarded as an excursus on the Rayleigh theory. In dealing with the more detailed phenomena of Arago's "positive" and "negative" polarisation, and the neutral points of Arago, Babinet, and Brewster, the author follows Soret in attempting a general explanation in which account is taken of the further action of other particles on the light already once diffracted, and of the form of the limited portion of the atmosphere from which the light reaching any individual eye can be received; but the conditions are too complicated to admit of quantitative treatment for exact comparison with observation.